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*medaefolia* (Kaulf.) Fée, its supposed nearest ally. From description and illustration the material appeared to the writer as probably no more than a luxuriant form of *P. andromedaefolia*, and a critical examination of the type, courteously lent by Mr. Moxley, has confirmed this view. The extent of variation within *P. andromedaefolia* is extremely great, even in a limited series of specimens, the differences seemingly dependent on conditions of moisture supply and insolation. The present specimen is exactly matched by other material in the National Herbarium from neighboring parts of southern California and is connected by numerous intermediate specimens with the commoner, more congested forms having smaller segments.

WASHINGTON, D. C.

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## The Fern Grottoes of Citrus County, Florida

ROLAND M. HARPER

In the extreme southeastern part of Citrus County, Florida, on the border between the lime-sink and Gulf hammock regions,<sup>1</sup> in about latitude 28° 40', are some limestone cliffs, chasms and grottoes, notable for their rare ferns, some of which are tropical species which do not range much farther north, and some are confined to Florida. Before describing the place it will be in order to sketch the history of its exploration by botanists, as far as known.

The first botanist to visit the locality seems to have been A. H. Curtiss, in April, 1881, which was a year or two after the publication of D. C. Eaton's Ferns of North America. Just what clue brought him there is not known; there were no railroads in the neighborhood

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<sup>1</sup> For map showing location of these regions see 3d Ann. Rep. Fla. Geol. Surv., pl. 16.

at the time, and he drove through the country from Gainesville, about 75 miles away. The ferns he distributed from there (using the names printed on his labels) were *Asplenium firmum* (No. 3723\*), *A. myriophyllum* (No. 3728), and *Aspidium trifoliatum* (No. 3752\*), the last being new to the known flora of the United States. (These asterisks are not footnote references, but part of Mr. Curtiss's system of numbering.) They are labeled "Limestone rocks in a forest at the head of Lake Tsala Apopka, Western Florida. April." As he was then making 125 sets of specimens, they are doubtless to be seen in all the principal herbaria of the world. In the Bulletin of the Torrey Botanical Club (8: 99-100) for September, 1881, D. C. Eaton reported the finding by Curtiss of *Aspidium trifoliatum* "on a rocky hummock<sup>1</sup> in Hernando County [Florida] in the middle of April last." In the supplement of the second edition of Chapman's Flora of the Southern United States, 1883, page 671, the same discovery is recorded.

On March 22, 1883, Capt. John Donnell Smith visited the same place or one very near it, and got a few species of ferns that Curtiss overlooked or at least did not collect. His finding of *Phegopteris reptans*, *Adiantum tenerum*, *Asplenium firmum*, *A. rhizophyllum*, and *Aspidium trifoliatum* "on the face of cavernous calcareous rocks in a hammock on the left bank of the Withlacoochee River, 15 miles from Brooksville, Hernando Co., Florida," was reported by Prof. Eaton in the Torrey Bulletin for September, 1883.

In 1887 Citrus County was formed from the northern part of Hernando, and about the same time a railroad was built to Brooksville, crossing the Withlacoochee

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<sup>1</sup> Mr. Curtiss probably wrote "in a hammock," but hammock was confused with hummock by northern writers through most of the 19th century. See Science II. 22: 400-402. Sept. 29, 1905. The locality was then in Hernando County, and Citrus County did not exist.

River at Pemberton's Ferry (afterwards Fitzgerald, now Croom), about eight miles above the fern locality. On February 12, 1891, Prof. L. M. Underwood, taking advantage of this railroad, visited the spot, and collected specimens labeled *Pteris Cretica*, *Asplenium firmum*, *A. rhizophyllum* and var. *myriophyllum*, *Polypodium pectinatum*, *Phegopteris reptans*, *Adiantum tenerum*, and *Aspidium trifoliatum*. Some of them are labeled "Istachatta," and some "Rocks, banks of Withlacoochee River 2½ miles below Istachatta." In the Proceedings of the Indiana Academy of Science for that year (pp. 86-87) he published the following observations:

"A still more interesting locality for the rock ferns is on the Withlacoochee River, two and a half miles below Istachatta. This town, which makes considerable display on the maps, consists of two houses and a store and must be reached from Pemberton, the nearest railroad station by boat or private conveyance. As the exact locality has never been defined it was by merest chance that we met Mr. F. M. Townsend, the proprietor of the store in Istachatta, who conducted Donnell Smith to the same location in 1883. The locality . . . was reached just at nightfall. Here, besides a much greater profusion of the species found at Ocala, are found the rare and variable *Phegopteris reptans* and a great profusion of *Aspidium trifoliatum*. Other stations are found near Brooksville and farther down the river on either side. In these sheltered sink holes, protected from frost and so far removed from sunshine as to retain moisture in the driest season, these relics of a tropical flora still persist, never attracting the attention of either the native 'cracker' or the northern migrant, both of whom stare alike at the botanist and his outfit and doubtless wonder what he can want of 'ferns'."

Shortly after that a railroad was built north and south through Citrus County, to serve the recently discovered phosphate mines, and passed within a mile or two of the fern grottoes. W. T. Swingle passed that way in 1894, and in the Columbia University herbarium there is a specimen labeled *Asplenium myriophyllum* from

"Limestone rocks at Istachatta," collected by him July 24, 1894, and distributed by Mr. Nash as his No. 1396a. In the summer of 1898 Prof. A. S. Hitchcock walked along the railroads of Florida from Monticello to Brooksville, thus passing very near the fern wonderland, but apparently without being aware of it. Soon afterward he published a list of Florida plants, based on his own collections and those of Curtiss and several others, and in this (Trans. Kan. Acad. Sci. 17: 96-97. 1901) nine species of ferns, including all those previously mentioned, are reported as having been collected at "Lake Tsala Apopka" or "Istachatta," by Curtiss.

Going back a little in our narrative, Mr. Curtiss was there again on August 18, 20 and 23, 1897, and collected in "Rocky woods near Istachatta" the following ferns using his names and numbers): *Adiantum tenerum* (5961), *Asplenium firmum* (5962), *A. myriophyllum* (5963), *Aspidium trifoliatum* (5964), *Phegopteris reptans* (5965), *Asplenium parvulum* (5966), and *Pteris Cretica* (5967).

In the Plant World (5: 68-70) for April, 1902 (published the latter part of May), Mr. Curtiss published a description of the locality, or localities, in question, which is so interesting that part of it will be quoted here, notwithstanding that the original is still comparatively accessible. He says:

"It was early in April, 1881. On the morning of the day before, at Gainesville, I had dropped a \$20 gold piece into a liveryman's hand for a four days' ride in a wagon with two horses and a negro driver. . . . Near noon of the second day, we came to a dense forest with wild orange trees on its border. On entering the forest it seemed as if I had suddenly entered another world, so different was it from anything I had seen in this state of terribly monotonous and tame scenery. My attention was first attracted to two skulls of cattle sticking in the narrow mouth of a chasm. The animals had evidently slipped in from an overhanging bank and been held by the horns till their bodies dropped off. Advancing into the dark

forest I found the surface to be rugged beyond anything I ever saw in mountain regions, being a succession of cliffs, pits, chasms and rocks of all sizes and forms, the whole being covered with spongy mold. And there was such a wonderful variety and profusion of beautiful West Indian ferns that after my first sensation of delight, I felt appalled at the idea of collecting so many sets, and I was then making 125 specimens of a kind. What gave me the most trouble, as well as pleasure, was the splendid *Aspidium trifoliatum*, then for the first time found in the United States.

"The fern hammock, as I call it (the word hammock being a southern substitute for forest, erroneously compounded with hummock by lexicographers) I reached by riding about two miles northward [from Istachatta] and then walking about one mile through fields. The ferns most abundant are *Asplenium myriophyllum*, *A. firmum* and *A. parvulum*, *Pteris cretica*, *Adiantum tenerum*, *Aspidium patens* and *A. trifoliatum*. On my first visit, when I struck another part of the hammock, I collected *Polypodium pectinatum*, and on my last I found *Phegopteris reptans* (a 'walking leaf') in one spot. I never went far into the hammock, being prevented either by lack of time or bad weather [doubtless referring to the heavy rains of summer]. It would be imprudent to explore this hammock alone. The last day I was there a slender sapling was all that saved me from falling backward from a ledge of rock over a sharp rock below. A day or two later a prominent citizen while hunting in the same hammock had his back broken and died after thirty-six hours of intense suffering. . . .

"Of the exquisite *Asplenium myriophyllum* there are two marked forms in this locality, and I have given both of them wide distribution. It seems that they differ only in size, but there is no apparent reason why one grows so much larger than the other."

In 1906 Prof. Underwood (Bull. Torrey Club **33**: 193-195) pointed out that these two supposed forms of *Asplenium myriophyllum* were specifically distinct from that West Indian species and from each other, and gave them new names. He also revised the nomenclature of one or two of the other ferns from the same place.

About 1908 Mrs. Mary A. Noble, an enthusiastic fern student living at Inverness, the county-seat of Citrus County, heard of this fern locality independently, and visited it, as well as a somewhat similar place a

few miles farther north, known as Britton's Caves. She writes me that the neighborhood used to be infested with "moonshiners," and an innocent stranger was once killed near there on suspicion of being a revenue officer. In January, 1909, I walked from Croom to Istachatta one afternoon, and asked one of the old residents of the latter place for information about the fern grottoes. He told me how to get there, but warned me of the danger of getting lost. For that reason, and also because of the lateness of the hour, I did not attempt to go to the spot then; and over six years elapsed before the opportunity came for some one to accompany me there.

In the fall of 1913 the U. S. Bureau of Soils published a soil survey of the "Ocala area," corresponding with four topographic maps of the U. S. Geological Survey published about 18 years before. The southern boundary of this survey is lat.  $28^{\circ} 45'$ , a little north of Floral City. The soil survey of Hernando County, published in 1915, stops at the county line just north of Istachatta. All the fern grottoes, as far as known, are in the space of six miles between the two surveys, and are thus not yet represented on either topographic or soil maps. There seems to be absolutely no mention of them in geological literature, and apparently no geologist had ever seen them until the time mentioned in the next paragraph.

On the morning of March 6, 1915, accompanied by the state geologist of Florida and his chief assistant, I left the southbound train at Istachatta, which is in the northeastern corner of Hernando County. New directions for reaching the fern place were easily obtained, and we walked north along the railroad about two miles, to a flag-station called Pineola, then east about a mile into the woods, which brought us nearly to the Withlacoochee River, opposite Bay Hill, Sumter



Limestone cliffs in the fern hammock near Pineola, covered with mosses and ferns.  
Pool of water in left foreground.



County. After leaving the open pine woods which characterize most of the lime-sink region we traversed first a sandy hammock full of saw-palmetto, which did not look very promising for ferns; but just as we were about to conclude that we were on the wrong trail a few limestone rocks appeared, the saw-palmetto was left behind, and we were soon at the desired spot.

It is difficult to describe the place satisfactorily. All the rock we saw was on two or three acres, at the edge of the river-swamp. It is a soft limestone, presumably of the Vicksburg formation (Upper Eocene or Lower Oligocene, practically the oldest formation exposed in Florida), and has been dissected by the processes of weathering into rugged cliffs and chasms, the highest being perhaps ten feet above the water. Some rocks tumbling against one another as they were undermined by solution formed natural bridges, and there were also a few small caves. At the time of our visit the river was higher than usual, and backed up among the rocks, preventing exploration of any of the caves.

The rocks were overgrown with a forest composed mostly of deciduous trees, such as *Carpinus*, *Quercus Michauxii*, *Q. Schneckii*, *Ulmus Floridana*, *Celtis*, *Morus rubra*, *Liquidambar*, *Negundo*, and *Cornus florida*, with *Taxodium distichum* and *Acer rubrum* in the wet hollows, the whole making a dense shade eight or nine months of the year. (They were already pretty well leafed out when we were there, the first week in March.) There were also two species of evergreen trees, *Quercus Virginiana* and *Persea Borbonia*, and some grape vines and other vines, but hardly any shrubs. The accompanying illustration will give some idea of the aspect of the place, though the photograph was made under unfavorable conditions, with the bright sunlight coming through the forest canopy in spots.

Ferns of all the species previously mentioned, as well as one or two others, were found growing all over the

vertical faces of the cliffs, together with *Thuidium* and other mosses. Whether the profusion of ferns was due primarily to the limestone, or to the shade and humus, the protection from wind and extremes of heat and cold, or the exemption from fire<sup>1</sup> afforded by the river-swamp, the rough topography, and the damp humus, is still an open question. Weather stations in the vicinity report some frost every winter, but the interior of the forest is of course better protected. I was not equipped for collecting specimens, not expecting to get back to headquarters for ten days or so, but my companions sent living material of some of the prettiest ferns by express to their homes in Tallahassee, and some of them were still growing when I left Florida in the fall.

We soon located the probable spot where "a slender sapling" saved Mr. Curtiss from serious injury, the sapling of 1897 being in 1915 a box-elder tree about eight inches in diameter. During the few hours we were there I met with an accident a little different from any described by previous explorers, but due in all probability to the same cause as most of them, namely, the softness of the limestone. I had stepped out on a projecting ledge to reach for the branches of a tree, when without warning a piece of rock weighing perhaps 200 pounds broke off under my weight and precipitated me into a pool of water six or eight feet below. Fortunately the water was only about a foot deep, I kept my balance (and did not even get my camera wet), and the rock did not roll over on me (as may have happened to the prominent citizen mentioned by Curtiss), so that no damage was done.

The latest contribution to the literature about this place is a short article by Mrs. Noble on "Fern hunting in the phosphate country," in the June number of this

<sup>1</sup> The only ferns known to the writer which grow in places frequently burned over are the species of *Osmunda*, *Anchistea* and *Pteridium*.

journal. (Her quoted definition of hammock on page 43 is spoiled by the accidental omission of nearly a line. The original of the quotation is in a footnote on page 217 of the third annual report of the Florida Geological Survey.)

The following is an annotated list of the ferns of this locality, with the names brought as nearly as possible up to date. The identity of some of them has long been in doubt, and the names of most of them have been changed in recent years (perhaps because fern taxonomists having comparatively few species to work with must keep revising them in order to keep busy), which seems unfortunate to an "outsider" who is not specially interested in ferns. I am indebted to Miss Margaret Slosson for assistance in straightening out some of the names.

*POLYPODIUM PLUMULA* HBK.

Mostly on bases of trees, not abundant. Fern students have long had trouble in distinguishing this from *P. pectinatum* L. Both species are reported from several other places in peninsular Florida and tropical America.

*POLYPODIUM POLYPODIOIDES* (L.) A. S. Hitchcock.

On trees. Widely distributed in the southeastern United States and tropical America.

*PTERIS CRETICA* L.?

On rocks. There has been much confusion between this and *P. multifida* Poir. (*P. serrulata* of many authors; see Underwood, *Torrey* 7: 196. Oct. 1907) and both have been suspected of being mere escapes from cultivation.<sup>1</sup> But it is inconceivable that an exotic plant could have become established at this locality at a time when there were no railroads or settlements near. It

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<sup>1</sup> See Fern Bull. 13: 9. 1905.

is widely but sporadically distributed, sometimes in artificial habitats, in the southeastern states and other warm countries.

**ADIANTUM TENERUM** Sw.

On rocks. The pinnae of this species are usually described as deciduous, giving the impression that they do not remain green through the winter, as do those of the related *A. Capillus-Veneris*. But it seemed perfectly evergreen at this time and place. However, it happens that the next day I visited the "Devil's Punchbowl" near Brooksville, which is reputed to be a great place for maidenhair ferns, without seeing anything of the kind; so perhaps the pinnae do not always persist until the new fronds appear in spring.

**ASPLENIUM HETEROCHROUM** Kunze. (*A. muticum* Gilbert.<sup>1</sup>)

On rocks. Florida, Cuba, and Bermuda. Very similar to *A. resiliens* Kunze (*A. parvulum* Mart. & Gal.), which has a similar habitat but much wider range.

**ASPLENIUM ABSCISSUM** Willd. (*A. firmum* Kunze. See Underwood, *Torrey* **7**: 198. Oct. 1907.)

Common on rocks. Also near Ocala, and elsewhere in peninsular Florida and tropical America.

**ASPLENIUM VERECUNDUM** (Chapm.) Underwood, *Bull. Torrey Club* **33**: 193. 1906.

Common on rocks. Reported also from Jackson, Marion and Dade Counties.

**ASPLENIUM CURTISSII** Underwood, *Bull. Torrey Club* **33**: 194. 1906.

On rocks. Known otherwise only from the vicinity of Ocala, Marion County. This and the preceding were formerly referred to the West Indian *A. myriophyllum* and *A. rhizophyllum*.

<sup>1</sup> See Maxon, *Contr. U. S. Nat. Herb.* **17**: 140. 1913.

*TECTARIA HERACLEIFOLIA* (Willd.) Underwood, Bull. Torrey Club **33**: 200. 1906.

Rather common on rocks, and conspicuous on account of its coarse fronds. Known also from Dade County, western Texas, and the West Indies. Formerly confused with the West Indian *T. trifoliata* (*Aspidium trifoliatum* (L.) Sw.

*DRYOPTERIS NORMALIS* Christensen.

Common on rocks. Widely distributed on Eocene and later limestones from Georgia to California and the West Indies. Until recently referred to *D. patens* (Sw.) Kuntze. No specimens from Citrus County seem to be in the New York collections, probably because collectors did not want to bother with such a common species.

*DRYOPTERIS FLORIDANA* (Hook.) Kuntze.

In rich humus. Widely distributed in the coastal plain of Georgia, Florida and Alabama. No specimens, probably for the same reason as in the last case.

*DRYOPTERIS RADICANS* (L.) Maxon, Contr. U. S. Nat. Herb. **10**: 490. 1908. (*Goniopteris reptans* (Gmel.) Presl; *Phegopteris reptans* D. C. Eaton.)

On rocks; one of the rarer species. Known from a few other localities in peninsular Florida, and in the West Indies.

A dozen species of ferns on a single acre is rather unusual in the United States, but by no means unprecedented. (See notes on the ferns of Scolopendrium Lake by Prof. Underwood in the Fern Bulletin for October, 1897.)

Now for what may be the last chapter in the history of the beautiful fern grottoes; and a rather sad one it is. In July, 1915, there appeared in several Florida newspapers an account of a wonderful cave that had been

discovered in opening up a new rock quarry in Citrus County, midway between Floral City and Istachatta. The item in the Citrus County Chronicle (published at Inverness), after describing the stalactites, fossils, etc., but saying nothing about ferns, closed with the remark that the proprietor was "loath to desecrate this bit of underground wonderland, but being of a frugal [or rather avaricious?] nature the prospects for turning it into some of the coin of the realm will probably prevail over his regard for it as a geological asset. And there will probably be no dissenters in these parts, for it has incurred great expense to equip the plant."

I was in the West at the time, but on returning to Florida early in October I wrote to Mrs. Noble and asked her if that meant the destruction of our fern locality near Pineola; and she replied that she thought it did, and "*sic transit gloria mundi*." But noticing that the item stated that the quarry property was midway between Floral City and Istachatta and embraced 26 acres of rock (while Pineola is about 5 miles from Floral City and 2 from Istachatta, and has much less rock than that), I wrote again to Mrs. Noble and urged her to investigate further. She kindly did so, and wrote me on Nov. 22 that the locality had not yet been disturbed, but the presence of some surveyors' stakes and prospectors' tools made the outlook rather discouraging. In a later letter she mentioned that the rights to all the limestone rock in the neighborhood had been purchased for \$60,000.

I also advised her to write for the Chronicle a protest against the proposed devastation of that interesting locality, and try to bring the matter to the attention of the State Federation of Women's Clubs, who have recently acquired control of Paradise Key or Royal Palm Hammock at the south end of the Everglades, for the purpose of preserving it in a more or less natural

condition.<sup>1</sup> She did write such an article, but it was mislaid in the printing office and never published; so the destruction is probably still going on unheeded. The locality here described, on account of the limited amount of rock above water-level, may be spared until the deposit a little farther north is exhausted; but it seems to be threatened with the same fate that overtook one of the hart's-tongue fern localities near Syracuse, N. Y.,<sup>2</sup> and the only Mississippi station for *Trichomanes Petersii*.<sup>3</sup> Any fern student who visits Florida in the near future, therefore, should make it a point to see the Pineola grottoes before it is too late, but bearing in mind the various perils above mentioned. There are no hotel accommodations near, but the place can easily be explored between the morning and afternoon trains in either direction. Possibly other equally interesting spots could be discovered near by, too.

COLLEGE POINT, N. Y.

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## An Adirondack Fern List

R. C. BENEDICT

The section of the Adirondacks with which I am familiar is notable for the large number of fern plants but the very small number of fern species. The Syracuse field meeting of the Society in July, 1915, resulted in the collection of forty different ferns, excluding lycopods, equisetes, and varieties. With two or three days' further exploration it would have been possible to find within the confines of Onondaga County nearly if not

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<sup>1</sup> See Small, Jour. N. Y. Bot. Gard. 17: 41. March, 1916.

<sup>2</sup> See Maxon, Fernwort Papers 31. 1900.

<sup>3</sup> See Underwood, Torreya 3: 18. Feb. 1903; Fern Bull. 13: 6. 1905. Nothing is said there about the destruction of the locality, but Prof. Tracy told me in 1905 that the rock (presumably Altamaha Grit) had been blasted away for railroad ballast.